CANape - First Steps
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Restrictions	Public Document
Abstract	The purpose of this application note is to give a step-by-step guide to establishing a connection to an ECU using the ASAM standard, CCP (CAN Calibration Protocol). This document provides basic information on how to create a CANape project, create a CCP driver type device and configure ECU parameter settings.

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1.0 Overview

CANape (CAN Application Environment) is an ASAM-MC-compliant measurement, calibration, test, and software development tool for electronic devices. Its main components include online and offline data analysis, direct read and write access to electronic control unit (ECU) memory, data management, synchronous periodic and event-driven data acquisition, flash programming, and an ASAM-MC2 controller device database editor. Connections to multiple ECUs are possible over CAN and other network buses such as Ethernet, Serial, and USB.

The purpose of this application note is to give a step-by-step guide to establishing a connection to an ECU using the ASAM standard, CCP (CAN Calibration Protocol). This document provides basic information on how to create a CANape project, create a CCP driver type device and configure ECU parameter settings.

2.0 CCP Driver in the ECU

A CCP Driver must be integrated in the ECU before CANape can connect to it. The Vector CCP Driver is included with the CANape software package free of charge. Unzip the file CCP.EXE, located in the *CCP* directory of the CANape software CD. The driver files CCP.C, CCP.H, and the configuration file CCPPAR.H are located in the *ccp* directory. A sample CAN Driver interface to the CCP file (CAN_CCP.C) is located in the *CANDRV* directory as well as the instruction file (CCP_DEMO.PDF) for integrating the CCP Driver with the ECU application. Please read CCP_DEMO.pdf in the *CANDRV* folder and CCP.DOC in the *DOC* folder before integrating the CCP Driver.

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CCPPAR.H is the CCP Driver configuration file that contains the CRO (**C**ommand **R**eceive **O**bject), DTO (**D**ata **T**ransmit **O**bject), and ECU (station) address information that will be used to configure CANape. If using a Vector CAN Driver, the CCP Driver can be configured via the CANgen tool.

```
/* CCP parameters */


/* CCP Identifiers and Address */
#define CCP_STATION_ADDR      0x0039      /* Define CCP_STATION_ADDR in Intel Format
*/
                                       /* High/Low byte swapped on Motorola machines
!!! (0x3900) */


#define CCP_STATION_ID    "LedProj"       /* Plug & Play station identification */


#define CCP_DTO_ID        0x7E1                /* CAN identifier ECU -> Master */
#define CCP_CRO_ID        0x667                /* CAN identifier Master -> ECU */
```

CANape interprets *CCP_STATION_ID* as the file name for the ECU controller description file. A benefit of this is that the correct ECU database is automatically assigned via the Plug and Play mechanism when the CANape program starts. If it is not possible to access to the CCPPAR.H file, the ECU developer should provide the necessary information. Detailed information on these identifiers is available in the document CCP.DOC.

After CCP integration is done, build the application and download it to the ECU. It is recommended that a linker map file created on build is used to build the controller description file.

The current CCP version is 2.1 and the Vector CCP Driver version is 1.42.

3.0 Configuring the Hardware

CANape uses a maximum of eight logical CAN channels. To make a physical connection to an electronic control unit, CANape logical channels must be assigned to the physical channels of the CAN hardware device (CANcardXL, CANcardX, CAN-AC2, CAN-AC2 PCI).

3.1 Assigning CANape to Physical Channels

Start the Vector Driver configuration program from the *Vector Hardware* icon in the Control Panel (**Start** → **Settings** → **Control Panel**). All CAN devices installed on the computer are listed under the *Hardware* tree. It is possible to assign the logical CANape channels to the physical hardware channels. To do this, select the hardware channel and press the right mouse button. Select **'CANape'** in the popup menu, then select e.g. CANcardXL Channel, then press the right mouse button and select a logical CANape channel (see Figure 1).

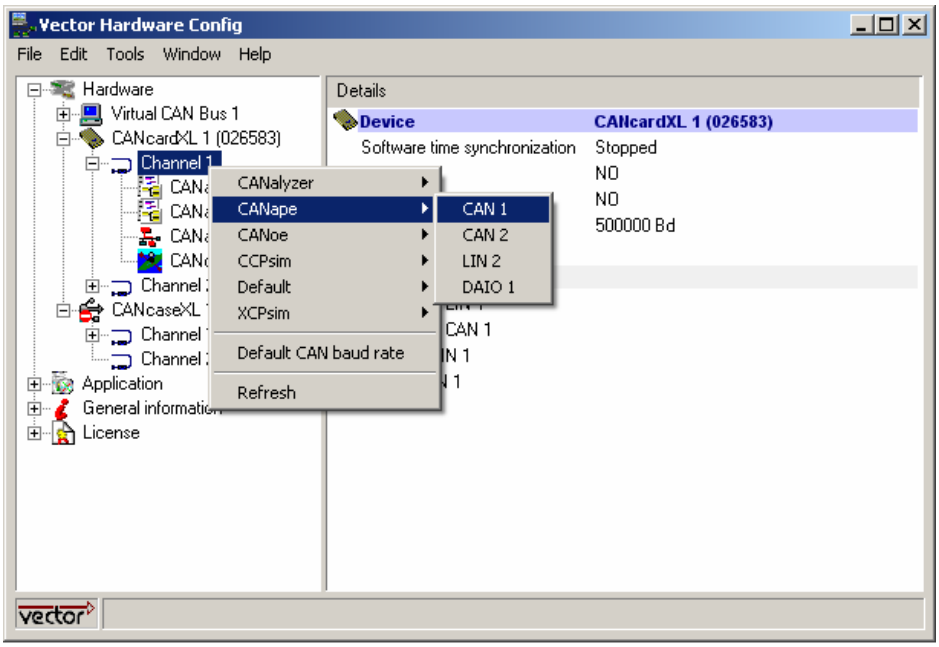

Figure 1 - Vector Hardware Window

Opening the tree view shows that the CANape channels CAN 1 and CAN 2 are assigned to physical CAN channels on the CANcardXL (see Figure 2).

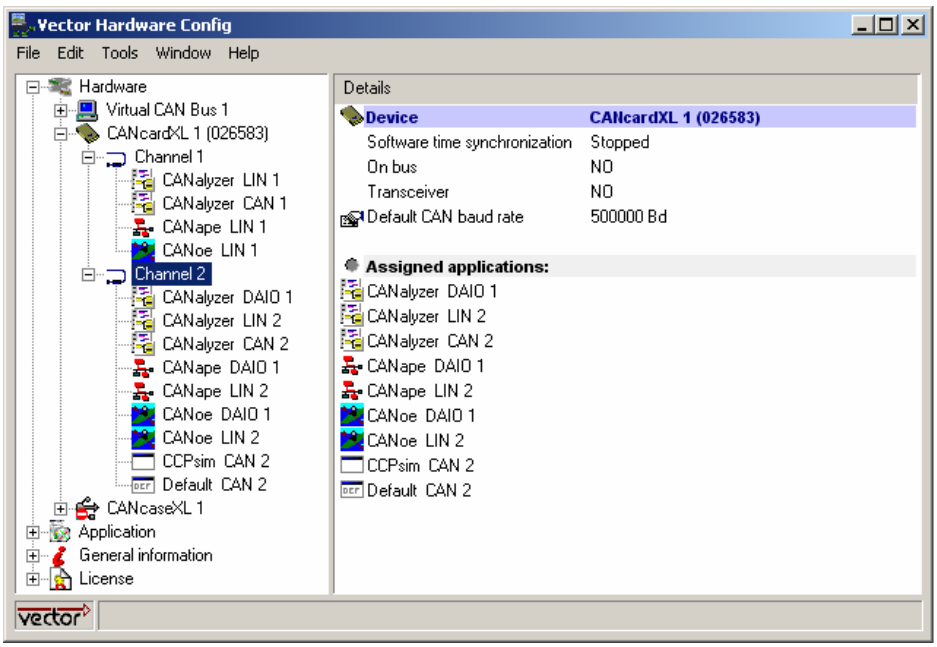

Figure 2 - Vector Hardware Window with TreeView Open

3.2 Connecting CAN Hardware to the CAN Network

It is now time to connect the CAN hardware device to the ECU. Make sure to use correct termination at both ends of the connection. Termination (120 Ohms, 5%, ¼ watt resistor) is required at the farthest ends of the bus to minimize signal reflections for high-speed data communication.

4.0 Creating a New Project in CANape

The physical connection is now properly set up and a CANape project can now be created. CANape projects should be created using the Project Wizard. When a new project is created, CANape automatically creates a subdirectory (working directory) with the name of the project and copies a project-specific initialization file called 'CANape.ini' into this directory.

4.1 Creating a New Project

Start the CANape Project Wizard from the Start menu (**All Programs** → **CANape 6.5** → **CANape**). The Project Wizard can be started by going to **File→New project…** and is where the following basic settings for a new project are configured:

- Project name
- Project (working) directory
- Links / Shortcuts

Enter a project name in the input box and press the **[Next]** button. Specify your own project directory path or accept the directory recommended by CANape, and then press the **[Next]** button.

In the next dialog box, CANape will create two shortcuts to the project. At least agree to the desktop shortcut, so that CANape can be started with this shortcut at a later time. Press the **[Next]** button.

On the last dialog page, check the **Start CANape immediately** option and press the **[Finish]** button. CANape starts with an "empty" configuration and an empty device list. At this point, only the initialization file *CANape.ini* is in the working directory.

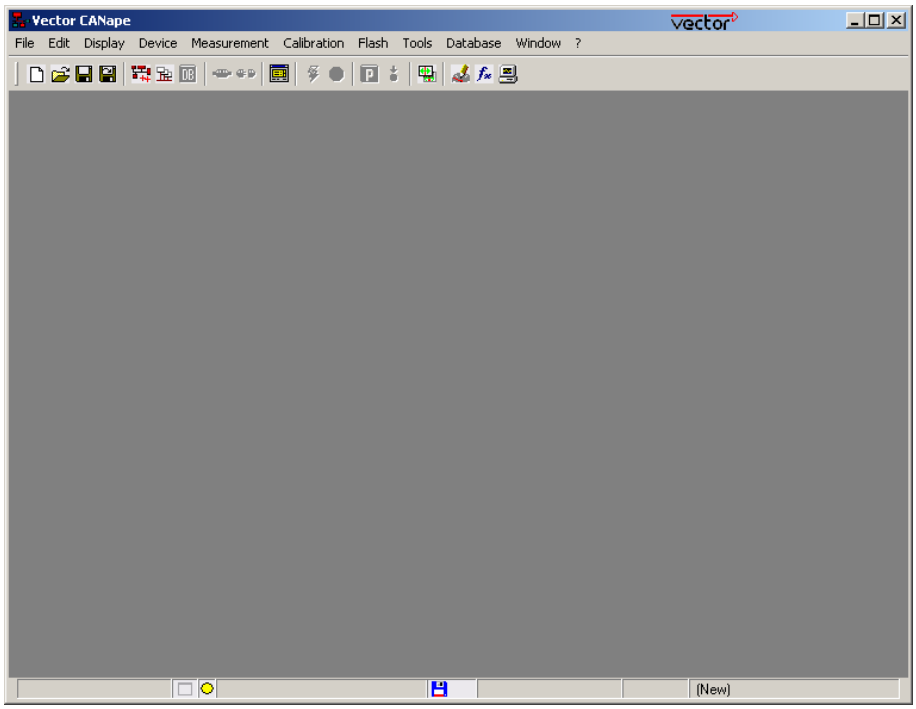

Figure 3 - Empty Configuration in a New CANape Project

4.2 Adding a Device to the Device List

All controller and external measurement data acquisition devices have to be made known to the CANape Device Manager. The Device Manager accesses the data in the device list where our device is defined.

Start the Device Manager by clicking on the CANape toolbar or selecting the menu item **Device → Device Configuration…** Click on the **[New]** button in the Device Manager, which will start a Device Configuration wizard (see Figure 4).

Note:	You will see a drop-down list on the **[New]** button. Ignore the other options for now and select **[New]**.

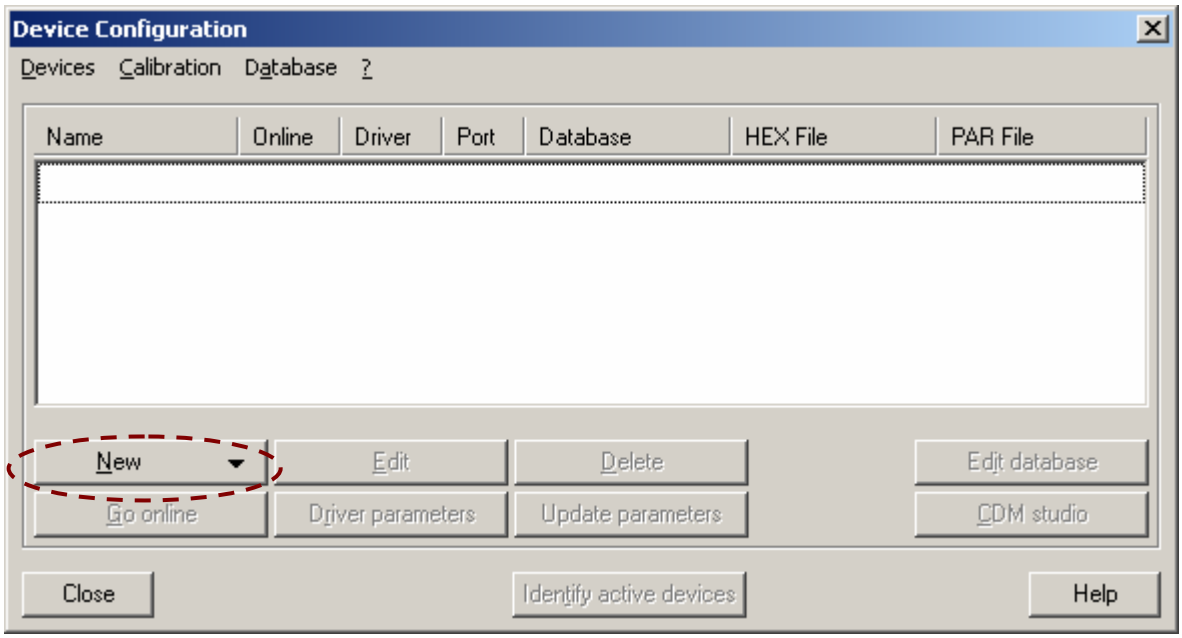

Figure 4 - Empty Device Configuration List

Enter the device name. The name can be the same as CCP_STATION_ID in the CCPPAR.H file in the CCP Driver or any project-specific name. The name entered here serves as a unique identifier for the device, and once created cannot be changed later. Press the **[Next]** button.

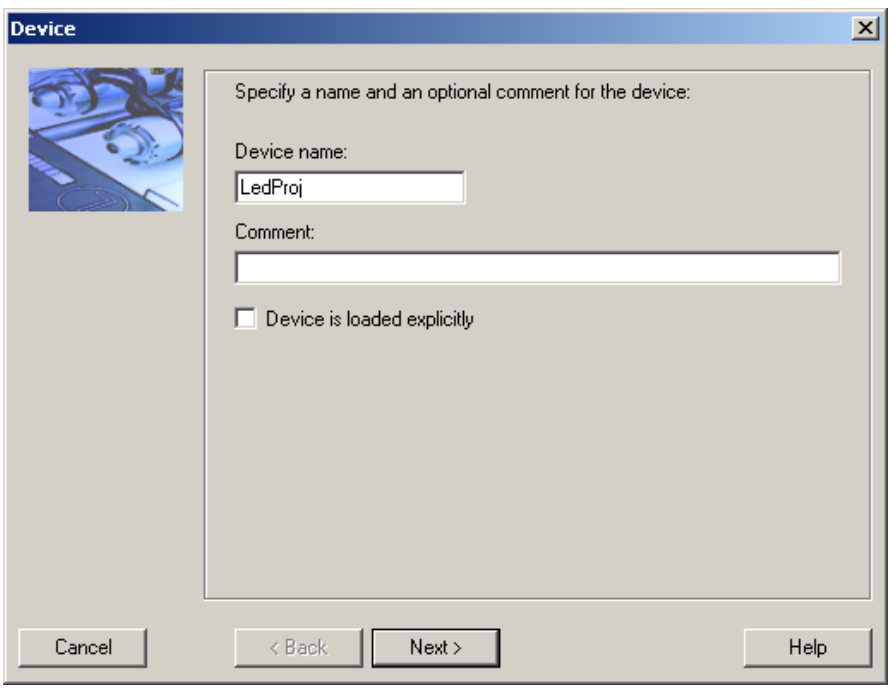

Figure 5 - Enter Device Name

In this application note, we will create a device of the type CCP Driver. Select *CCP* to be the driver type from the drop-down list and press the **[Next]** button.

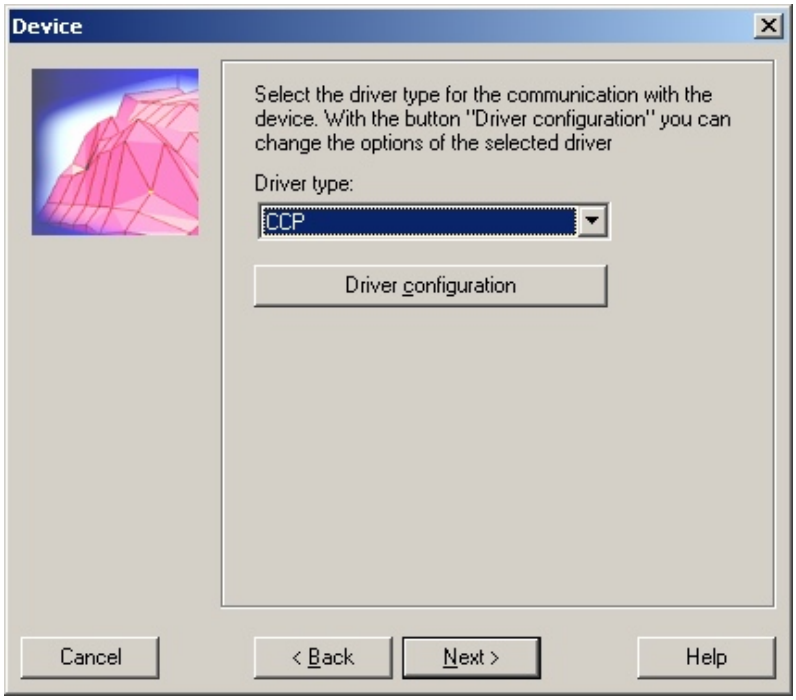
Device
Select the driver type for the communication with the device. With the button "Driver configuration" you can change the options of the selected driver
Driver type:
CCP
Driver configuration
Cancel
< Back
Next >
Help

Figure 6 - Select Driver Type (CCP in this example)

If a controller description file already exists in the ASAP2 or DB format, uncheck **Automatic detection of the database name** and specify the database directory and file name. Say 'Yes' to using the specified database file and 'Yes' to using ASAP2 settings, if applicable.

If there is no database, create an empty one by leaving the default database directory. The A2L database format is selected by default, since it is ASAM-MC2-compliant and the specifications are public (http://www.asam.net). The A2L format is more compatible among different tools and even different versions of CANape.

Note:	If the controller does not support the Plug and Play mechanism, **Automatic detection of the database name** must be disabled and a database must be selected by pressing the **[Browse]** button.

It is also possible to specify a directory for storing parameter files in this dialog. Press the **[Next]** button.

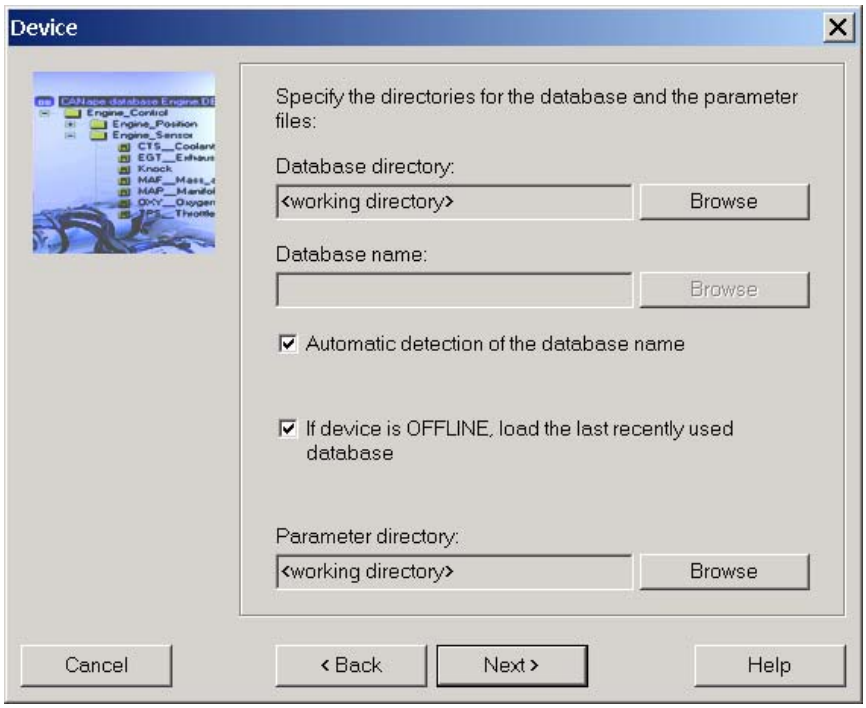

Figure 7 - Settings for the Controller Database File

A linker map file can be used directly to create a controller database during program development (see Figure 8). If there is a program change that results in address shifts in the linker map file, addresses of existing database entries can be updated upon request in CANape. If an existing linker map file is available, select *MAP file(s) predetermined*. Then select the directory where the map file is located by clicking on the **[Browse]** button. Select the map file format by selecting the compiler type from the drop-down list. For example, if a Cosmic compiler was used to build the application and create an IEEE map file, select *IEEE (Tasking, Cosmic, Microtec)* from the list and enter the file name.

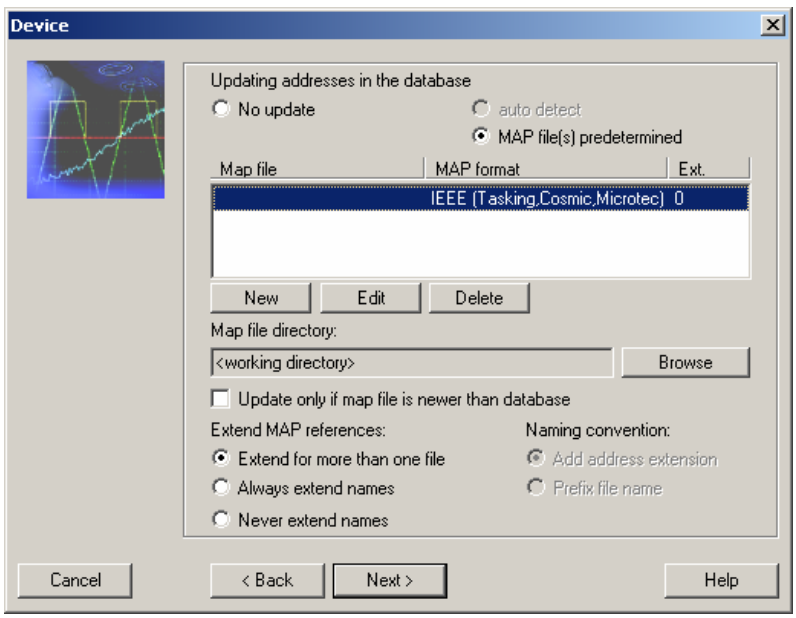

Figure 8 - Settings for the Linker Map File

The settings for the controller's HEX file (cache memory) are entered on the next dialog page. The values of calibration objects are placed in this file and can be changed in offline mode. When CANape is exited or the ECU is disconnected, all values that were changed are stored in the HEX file *xx.hex*, where xx is the name of the controller database used. The changes made in offline mode can only be downloaded when the ECU is reconnected to CANape.

Accept the default CANape settings and press the **[Next]** button.

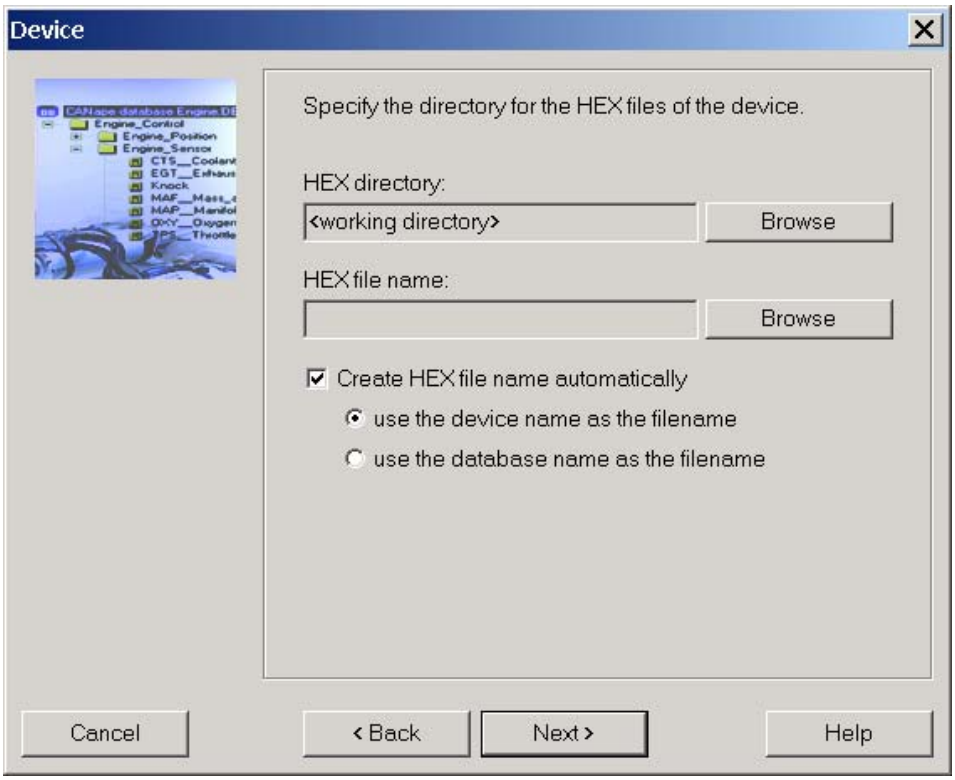

Figure 9 - Settings for the Hex File

We are now at the last dialog page of the Device Wizard, where a summary of CCP device settings is displayed. Click on the **[OK]** button. CANape then attempts to establish a connection to the controller. Since we have not configured the driver settings yet, click on the **[Go Offline]** button. At this point, if the name of an existing database was not specified, CANape will ask for a new database file name. Enter the CCP_STATION_ID value from the CCPPAR.H file as the database name. In this example 'LedProj' is used as the name. Say 'No' to importing an existing database and 'Yes' to creating a new database, which exits and then returns to the device list dialog.

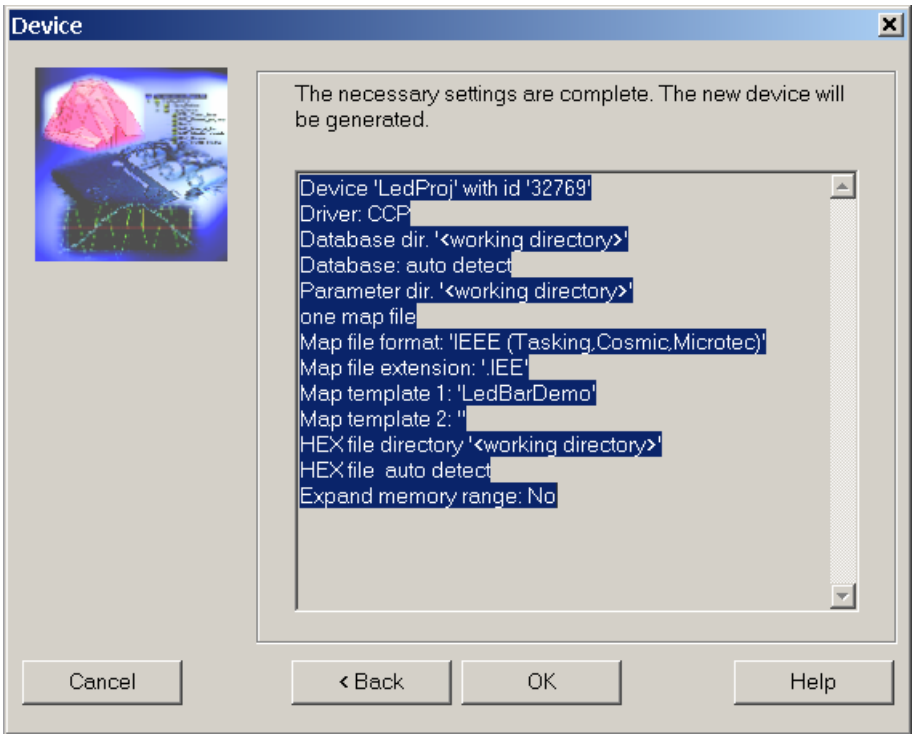

Figure 10 - Summary of Device Configuration

4.3 Configuring CCP Driver Settings

In the device configuration window, click on the **[Driver Parameters]** button to open the driver configuration dialog.

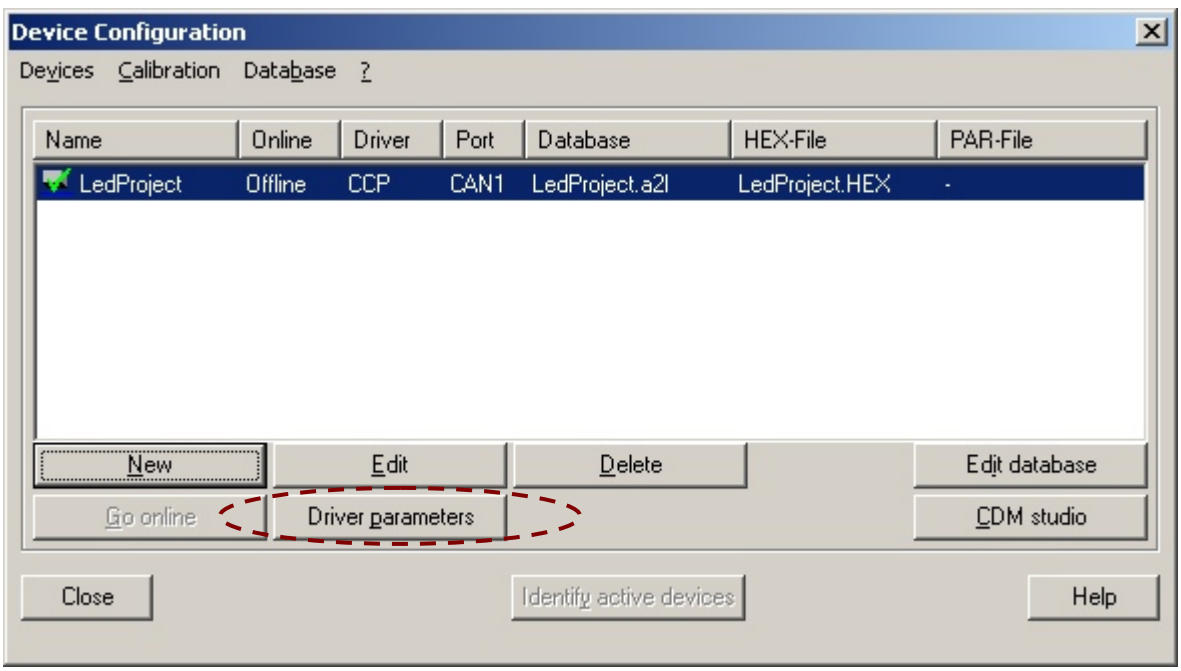

Figure 11 - Device Configuration List with New Device

To establish a connection with the controller, the basic settings needed are the CRO identifier, the DTO identifier and the ECU address. The CRO is the CAN message that transmits CCP commands from CANape to the controller, and is defined as CCP_CRO_ID in the CCPPAR.H file. The DTO is the CAN message that forwards the response transmitted by the controller to CANape and is defined as CCP_DTO_ID in the CCPPAR.H file. Enter the CRO and DTO information in the input fields. The ECU address is defined as CCP_STATION_ADDR in the CCPPAR.H file.

Set the ECU format to be either *Intel* or *Motorola* based on your microprocessor type. Select the CCP version.

Uncheck the **'SeedKey'** and **'Overload detection'** settings for now.

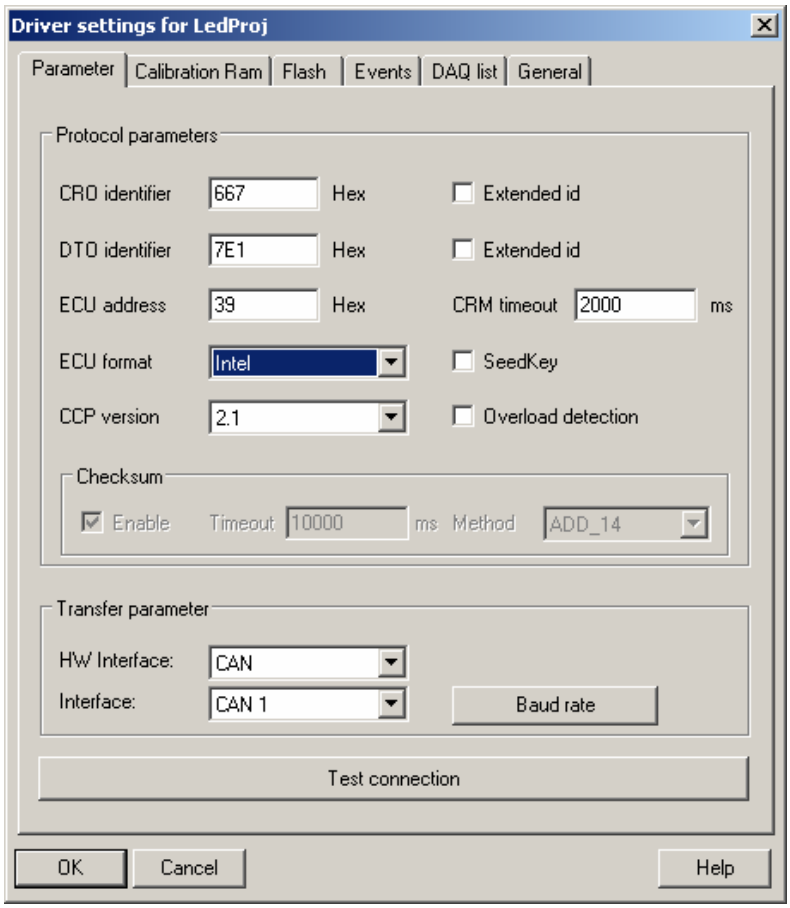

Figure 12 - Driver Parameter Settings for CCP Device

In the *Transfer parameter* section, select the correct CAN channel (CAN 1) and set up the baud rate and bus timing registers.

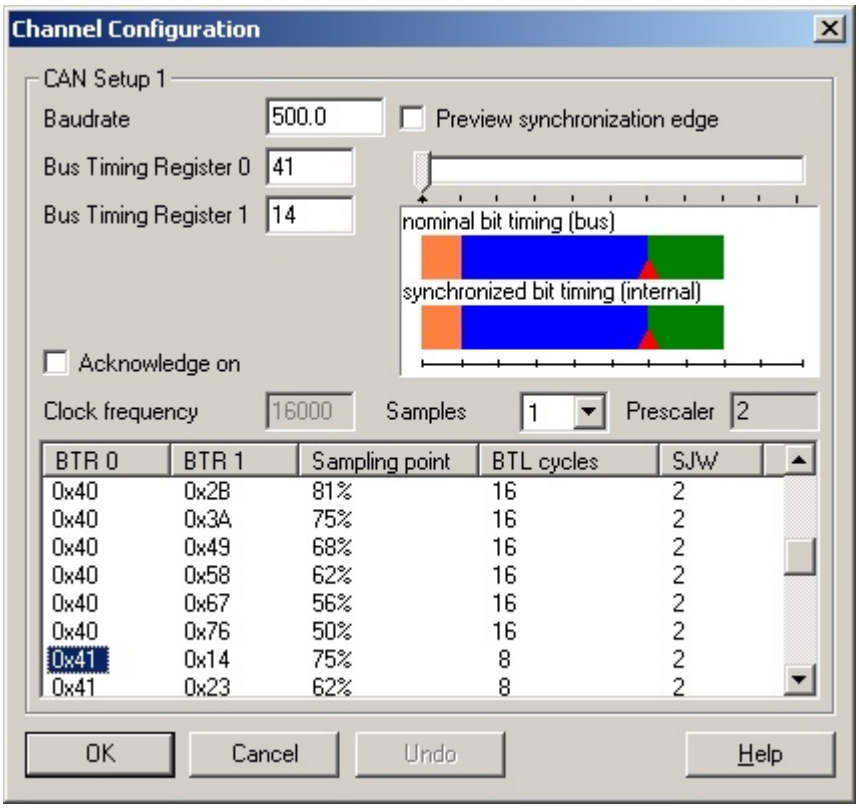

Figure 13 - Baud Rate and Bus Timing Register Settings in CANape

All needed settings have now been made to establish a connection with the ECU. To see if it is possible to go online, click on the **[Test Connection]** button under the **Parameter** tab. If the settings made are correct and a connection is made to the device, a message will be displayed: '(device name): ECU is ONLINE'.

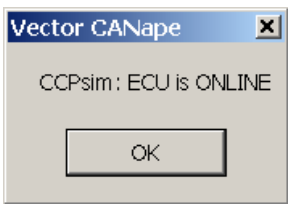

Figure 14 - Communication is OK

Congratulations! CANape has successfully established a connection with the ECU. Close the *CCP Device Setup* window and the *Device Manager* window.

4.4 Creating a Database

In order to measure and calibrate the ECU data objects, a controller description file must be created. The associated map file contains the object name and its memory address. Based on the map file format, it may contain more useful information like data type, etc.

Open the ASAP2 database editor by clicking on the button on the toolbar or by selecting the menu item **Database → Editor…**. If a new database has been created, this will be blank. We can directly insert ECU variables into the database using the linker map file. It is possible to create measurement, parameter or calibration objects, and virtual signal types.

In the ASAP2 Database Editor, select the menu item **Edit → Insert from map file…** A dialog page opens with a list of all map file objects and their addresses. Select an object from the list to be calibrated and press **[OK]**. Click the **[Calibration] button** as the object type. A parameter object can now be seen in the database, and it is denoted by the symbol. (Refer to the CANape User manual for a detailed description of all database symbols).

Insert another variable from the map file, but this time as a measurement object, denoted by the symbol.

Now there is one object to be calibrated and one object to be measured. Save and close the database editor.

4.5 Adding Database Objects to Display Windows

CANape offers options to display database objects in multiple formats. Measurement objects can be displayed in graphic, numeric, digital, or bar format. Calibration objects can also be displayed in graphic or numeric format.

Go to the CANape menu item **Display → Calibration Windows → Calibration Window**. Select the desired calibration variable to be read and modified from the popup database and click the **[Apply]** button in the toolbar. Close the database.

To display a measurement object, the object first has to be added to the Measurement Configuration List. Go to the menu item **Measurement → Measurement configuration…** or select the icon on the toolbar. Right click in the right window and select **'Insert Signal…'**, which will open the Database Editor where the desired measurement object can be selected. Select the measuring mode to be polling at 100ms. If a DAQ has been implemented in the ECU, it is possible to create timer events (please refer to CCP_TEST.PDF for more information). Close the configuration list.

Select the menu item **Display → Measurement Windows → Graphic window…** Right click in the empty window and select **'Insert measurement signal…'**. Select the measurement signal from the measurement configuration list and click **[Apply]**. Close the configuration list.

Click on the symbol in the toolbar to run the measurement. If CANape is not online, a prompt will ask if CANape should be connected. Say 'Yes' to connect.

At this point you are connected to the ECU and successfully using measurement and calibration options of CANape.

5.0 CCPlog

CANape CCP communication to the ECU can be monitored and logged using the CCPlog utility that is included in the CANape installation. The file CCPLOG.EXE is located in the CANape\Exec folder.

Note:	It is recommended to start CCPlog before starting CANape to capture CANape initialization messages as well.

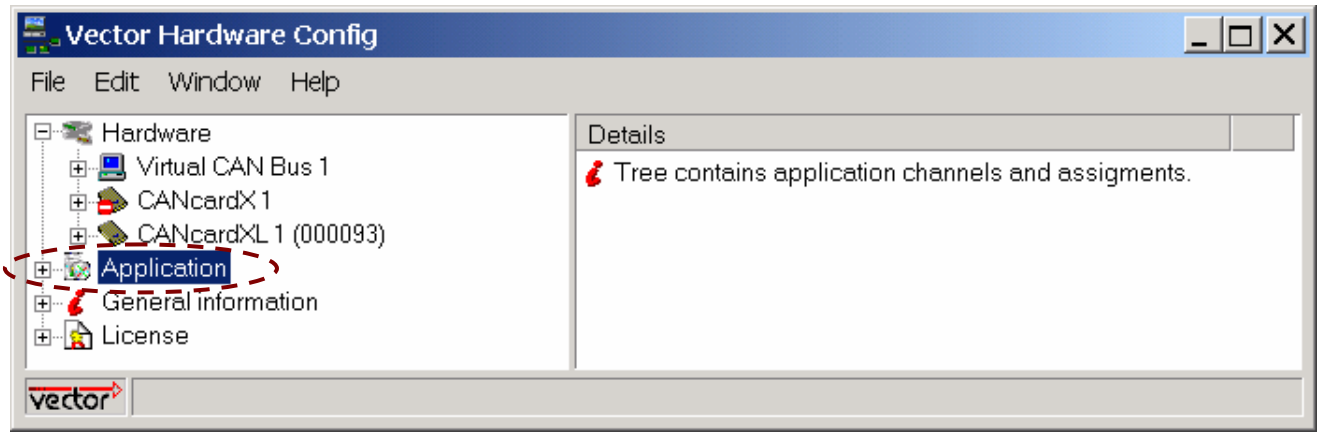

Figure 15 - Application Settings in Vector Hardware Configuration

Open the Vector Hardware Config (Control Panel→Vector Hardware). Select **'Application'** and press the right mouse button. Select **'Add application'** from the popup menu, which displays the *Application setting*s dialog. Enter *CCPlog* as the *Application name*. Specify the *Number of CAN channels* as *1* and press the **[OK]** button.

Note:	The CCPlog application in Vector Hardware only needs to be added once.

Assign *CCPlog* to the channel to which CANape is assigned. Close the Vector Driver Configuration window.

Start the DOS command prompt. Locate the CANape\Exec folder. By default, CANape is installed in the `C:\Program Files` directory.

```
C:\>cd progra~1\CANape\Exec_
```

Typing *ccplog –h* at the prompt calls help on how to set the switches on the command line.

```
Usage:
  CCPlog [options]

  Options:

    -tx      Set output verbosity to x
                1 - Print commands
                2 - Print commands and responses
                3 - Print commands, responses and all other can messages
    -bx      Set bit rate to x (Default is not initialized)
    -crox    Set CRO id to x (decimal)
    -dtox    Set DTO id to x (decimal)
    -verx    Set version number to x (default is 200)
    -m       Set byte order to Motorola
    -e       Set the acceptance filter for extended id's
    -l       Write a Log File with the name CCPLOG.LOG (Binary)
    -o       Read the Log File and write it to the screen
```

```
Keys:
  0-3      Set output verbosity to x
  s        Print Statistics
```

For example, if CANape is assigned to CANcardXL Channel 1 with baud rate = 500K, CRO = 0x667, and DTO = 0x7E1, enter the following at the prompt:

```
ccplog -t3 -b500000 -cro1639 -dto2017
```

The value 1639 is decimal for 0x667 and 2017 is decimal for 0x7E1. These values will show the CCP communication on the screen.

If a log file of these messages is needed, add > *log.txt* at the end of the above command like this:

```
ccplog -t3 -b500000 -cro1639 -dto2017 > log.txt
```

Adding this will create a LOG.TXT file in the CANape\Exec folder with CCP messages. Refer to the CCP21.PDF document under the CCP\CCP.EXE file in the CANape installation CD, which contains the breakdown of each CCP command and response.

Press the <ESC> key at any time to stop CCPlog.

6.0 Frequently Asked Questions

1. The error message "CAN: CAN-ERROR: No hardware channel assigned to logical channel 1" is generated when trying to connect CANape to the ECU.
   CANape is not assigned to correct physical channels. CANape is most likely assigned to virtual channels. Go to **Start** → **Settings** → **Control Panel** and double click on the *Vector Hardware* icon. Assign CANape 1 to hardware Channel 1 and CANape 2 to hardware Channel 2.

Note:	If the CCPsim demo program is run using the CCPsim ECU simulator, CANape will be automatically assigned back to virtual channels.

2. The error message "*yourDeviceName*: No response from ECU" is generated when the **[Test Connection]** button under Driver Configuration is clicked.
   There can be a number of reasons why CANape would not be able to connect to the ECU:
   a) CANape logical channels are not assigned to correct hardware channels. (See Section 3.1)
   b) CAN cable connections are not properly terminated. (See Section 3.2)
   c) The specified baud rate and bus timing registers in CANape are not matching the values in the ECU.
   d) CRO, DTO and station address values in CANape under driver configuration are not matching the ones in the ECU. (See Section 4.3)

7.0 Important Details, Special Constraints, or Other Influences

The example provided in this application note is generated using CANape Version 6.5 Service Pack 3.

8.0 Additional Resources

The following material may provide further useful information:

AVAILABLE ON VECTOR'S WEBSITE

- CANape User Manual
- Network Interfaces Installation Guide and Manual

OTHER RESOURCES

- CANape Online Help
- The CCP CAN Calibration Protocol V2.1 and the free CCP Driver can be found at the following website: http://www.vector-cantech.com

9.0 Contacts

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